

Patent Application  
NC 83,028

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

Claim 1 (currently amended) A method of making a an electronic device comprising the steps of :

- (a) patterning the mask material to form openings therein extending to the substrate surface forming openings in a dielectric thin film mask material disposed on a semiconductor substrate surface to the substrate surface itself;
- (b) growing by confined epitaxy active material in the openings;
- (c) removing the mask material to form the device with extended defect density and having reverse bias leakage current of less than  $1 \times 10^{-9}$  amps in the grown active material; and
- (d) depositing electrical contacts on the device- and
- (e) providing at least one electronic device in the grown active material.

Claim 2 (original) The method of claim 1 including the step of cleaning the exposed substrate surface to make it ready for epitaxial deposition of the active material.

Claim 3 (currently amended) The method of claim 2 including the step

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of depositing a resist material on the substrate surface before depositing the mask material; patterning the mask material; developing the resist material and removing ~~and~~ the mask material to create the openings where the active material is grown.

Claim 4 (original) The method of claim 1 including the step of doping the active material.

Claim 5 (currently amended) The method of claim ~~1~~ 3 including the steps of depositing a resist material on the mask material and developing the resist material, said patterning step including removal of the mask material and the resist material to create the openings.

Claim 6 (original) The method of claim 1 wherein open area on the substrate surface is in the approximate range of 1 % to 99 %.

Claim 7 (original) The method of claim 2 wherein the substrate surface includes a thin film of a starting material.

Claim 8 (original) The method of claim 7 wherein the starting material is the active material.

Claim 9 (original) The method of claim 3 including the step of cleaning the substrate surface coated with the resist material and the mask material.

Claim 10 (currently amended) The method of claim ~~1~~ 7 wherein the substrate surface is a thin film of the active material to allow for growth of the active material thereon.

Claim 11 (original) The method of claim 6 wherein growth of the active

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material in the openings is at a rate of approximately 1  $\mu\text{m}/\text{hr}$  to 30  $\mu\text{m}/\text{hr}$ .

Claim 12 (currently amended) The method of claim 2 wherein thickness of the deposited mask material is in the approximate range of 1000  $\text{\AA}$  to 2000  $\text{\AA}$ .

Claim 13 (currently amended) The method of claim 2 1 wherein the substrate surface is selected from the group consisting of sapphire, diamond, silicon carbide, lithium aluminate, and lithium gallate; the mask material is selected from the group consisting of silicon dioxide and silicon nitride; and the active material is selected from the group consisting of gallium nitride, aluminum gallium nitride and indium gallium nitride.

Claim 14 (currently amended) The method of claim 2 5 wherein the resist is selected from positive, negative and mixtures of the resists.

Claim 15 (currently amended) A device having reduced extended defect density and reverse leakage current of less than  $1 \times 10^{-9}$  amps comprising a substrate, a semiconductor active material deposited on said substrate and having atomically smooth surfaces, at least one electronic device disposed in said active material where current flow can be controlled, and electrical contacts on said device.

Claim 16 (original) Device of claim 15 wherein said substrate is selected from the group consisting of sapphire, diamond, silicon

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carbide, lithium aluminate, and lithium gallate; and said active material is selected from the group consisting of nitrides that have a tunable direct bandgap in the approximate range of 0.8 eV to 6.2 eV.

Claim 17 (original) Device of claim 15 wherein said active material is selected from the group consisting of gallium nitride, aluminum gallium nitride and indium gallium nitride.

Claim 18 (original) Device of claim 15 that can operate at frequency in the approximate range of 1 GHz to 100 GHz and power in the approximate range of 2 W/mm of gate periphery to 10 W/mm of gate periphery, wherein said substrate is selected from the group consisting of sapphire and silicon carbide and said active material is selected from the group consisting of gallium nitride, aluminum gallium nitride and indium gallium nitride.

Claim 19 (currently amended) Device of claim 15 that has reverse bias leakage current below  $1 \times 10^{-7}$  amps wherein said substrate is selected from the group consisting of sapphire and silicon carbide and said active material is selected from the group consisting of gallium nitride, aluminum gallium nitride and indium gallium nitride.

Claim 20 (original) Device of claim 19 wherein said electrical contacts are selected from suitable metallic materials.